Derivation 1: In class I derived the following relationships between the reflection and transmission coefficients:

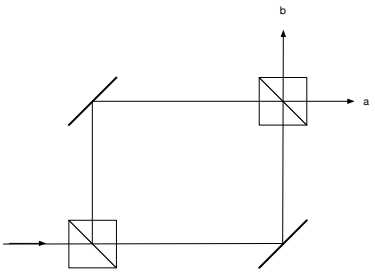
$$|r_3|^2 + |t_4|^2 = 1 = |t_3|^2 + |r_4|^2$$

$$|r_3|\,|t_3| = |t_4|\,|r_4|$$

From these relations, show that

$$|r_3| = |r_4|$$
$$|t_3| = |t_4|$$

Derivation 2: Recall the Mach-Zehnder interferometer:



In class I showed that the probability of detection for the a channel was

$$P_a = \frac{1}{2}\left(1 + \cos(\Delta k \delta)\right)$$

Repeat the analysis for the b channel and show that

$$P_b = \frac{1}{2}\left(1 - \cos(\Delta k \delta)\right)$$